CLAIMS

1. A digital modem, comprising :

a modulation circuit for outputting respectively as modulation signals,

a signal h[k] whose amplitude frequency characteristic is constant, and the phase thereof varies in proportion to the square of the frequency (namely, group delay proportional to the frequency),

when a transmission symbol is 1, and

a signal h[-k] which is the signal h[k] right and left inversed on the time axis,

when a transmission symbol is -1; and

a demodulation circuit for determining the difference between,

the square thereof after linear convolution of said modulation signal and the signal h[-k] which is the sequence h[k] right and left inversed on the time axis, and

the square thereof after linear convolution of the modulation signal and the sequence h[k],

for modulation / demodulation of 1 /-1 binary signal.

2. The digital modem of claim 1, wherein an analogue circuit is adopted for output processing of a modulation signal in said modulation circuit and / or convolution processing of a modulation signal in said demodulation circuit.

3. The digital modem of claim 1, wherein :

said signal h[k] is a series h whose discrete Fourier transform is

$$DFT(h[k]) = \begin{cases} \cos\beta n^2 + j\sin\beta n^2 & (0 \leqq n \leqq L/2) \\ \cos\beta (L-n)^2 - j\sin\beta (L-n)^2 & (L/2 < n < L) \end{cases}$$

where, L is the length of the series h, the range of k is $0 \leqq k < L$, and β is a constant taking a value other than 0.

4. The digital modem of claim 1, wherein :

said signal h[k] is a sequence h making :

$$h[k] = 1 - 2\mathrm{mod}_2\left[\frac{k^2}{2L}\right]$$

where, L is the length of the series h, the range of k is $0 \leqq k < L$, $\mathrm{mod}_2(x)$ is the remainder of division of x by 2, and $\lfloor x \rfloor$ is an integer not exceeding x.

5. The digital modem of claim1, wherein two sweep signals used for modulation of said binary signal and two FIR filter coefficients used for demodulation are defined as

$$y_1[n] = \sin(\alpha n^2 + \beta n - r) \qquad (0 \leqq n < N)$$

$$y_2[n] = y_1[N - 1 - n] \qquad (0 \leqq n < N)$$

where N is length of sweep signal $y_1[n]$, $y_2[n]$, and α, β, γ are arbitrary constants.

6. The digital modem of claim 1, wherein two sweep signals used for modulation of said binary signal are defined as equation(01)

$$y_1[n] = \sin(\alpha n^2 + \beta n - r) \qquad (0 \leqq n < N)$$

$$y_2[n] = y_1[N - 1 - n] \qquad (0 \leqq n < N), \text{ and,}$$

two FIR filter coefficients used for demodulation thereof are defined as equation(02)

$$h_1[n] = \begin{cases} 1 & (\text{if } 0 \leqq y_1[n] \\ -1 & (\text{if } y_1[n] < 0) \end{cases}$$

$$h_2[n] = h_1[N - 1 - n] \qquad (0 \leqq n < N),$$

where N is length of sweep signal $y_1[n]$, $y_2[n]$, and FIR filter coefficient $h_1[n]$, $h_2[n]$,and α, β, γ are arbitrary constants.